PRELIMINARY REPORT

ON

A QUANTITATIVE STUDY OF THE DEPREDATIONS BY DENDROCTONUS BEETLES IN NORTHERN IDAHO.

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February 5th, 1921.

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INTRODUCTION

In this report the result of the past years work on the above problem is presented. No generalizations or deductions from the data secured will be made as sufficient time has not been spent on the problem to substantitate the existence of any present theory. The description of the areas which are being studied has been presented to Dr. A. D. Hopkins, in a memorandum under date of January 17th, 1920, but will be included within this paper in order to have essential data in the one report.

PURPOSE OF INVESTIGATION.

1. To determine the importance, from an economic viewpoint, of the depredations by Dendroctonus beetles in the forests of Northern Idaho.

2. The cause, character, and period of time relative to the intermittent increase and decrease in the annual infestation.

3. Studies of seasonal history, conditions influencing rate of mortality, factors which induce beetles to attack certain individuals of their host species, flight habits, forest fires and subsequent insect

epidemics, etc. These studies to be carried on in conjunction with Dr. Hopkins's investigation of the bioclimatic law. Investigations will also be made for possible and practical control measures.

4. To investigate secondary insects and bark beetles of minor importance, with the character and extent of damage involved. Also the relation of these insects to the primary species.

CONDITIONS

The depredations in the pine forests by Dendroctonus beetles is by far our most important problem of Forest Entomology, in Northern Idaho. The commercial species are yellow and white pine, and it is upon these that the lumbering industry of this region is based. The alarming insect epidemics of the past have occured in the white pine forests. Lodgepole pine stands have harbored severe infestations in many places, and there is a constant depletion of the yellow pine forests which varies yearly as to severity. In many areas where engelmanni spruce is found associated with white pine, it has been severely depleted in the past ten years by insect attack.

A very small loss in the douglas fir stands occurs each year from the attacks of Dendroctonus pseudotsugae, and Buprestidae. This

species does not hold a very high commercial rating in Northern Idaho.

There are two distinct and seperate forest types in this locality. These may well be called the Western White Pine (Pinus monticola), and the Western Yellow Pine (Pinus ponderosa), types. Western white pine is found on the North slopes and flats of the higher mountains. It grows also on other exposures in protected coves and watersheds, the best growth being obtained in deep porous soil. The associate species are douglas fir, western hemlock, engelmann spruce, and western larch. Western yellow pine is found in a more open forest type on Southern exposures and open valleys and flats. Grows on lower elevations in dry rocky soil. Associate species are douglas fir, lodgepole pine, western larch, western hemlock, and grand fir.

These two types will cause the division of the problem into two seperate phases, as follows; Depredations in Western White Pine by Dendroctonus monticolae, and Depredations in Western Yellow Pine by Dendroctonus brevicomis. The associating species in these two types are of no great economic importance, and will not merit a seperate study at this time. However as some of these species are subject to insect attack each year, a record of this damage will be included with the records of the two type species

LOCATION, DESCRIPTION, AND HISTORY OF AREAS TO BE STUDIED.

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Depredations in Western White Pine by Dendroctonus monticolae.

In order to locate an area favorable for the study of the depredations in white pine by Dendroctonus beetles, it became neccessary to enter the Coeur d'Alene National Forest. With splendid cooperation the officers of the Forest Service, both of the District Office of Missoula, Montana, and of the local office at Coeur d'Alene, Idaho, entered into the spirit of the investigational program and placed in the hands of this station an area containing the headwaters of Independence Creek, to be used as an experimental area for a period of five years. A special use permit was issued to this station from the Forest Service covering this permission.

The location of this tract is well adapted to this problem as it is surrounded by large burned over areas many miles in width, (See map of Coeur d'Alene National Forest) giving an isolation from other bodies of timber which will serve to eliminate the influence of outside conditions and factors. This tract is fairly accessible from the Coeur d'Alene Station, and can be reached in one days travel.

The area has been divided into three units, namely Independence, Snow, and North Creek Units. It is planned to cover each unit every year by an intensive reconnaissance, however during the past

season Independence Creek was the only one cruised intensively, and the other two were covered by the topographical method and checked by the intensive data. In addition to the work within this area a very extensive survey is made each year obtaining a general knowledge of the insect damage through-out the white pine stands of the Coeur d'Alene National Forest

History and previous observations by the writer show that the depredations in the white pine stands of the Coeur d'Alene National Forest, started increasing about 1910, and became serious epidemics in 1912, and 1913. In 1914 this infestation started to decrease and by 1917 had reached an endemic or normal stage.

Depredations in Western Yellow Pine by Dendroctonus brevicomis.

The area selected for this study, though not as well adapted as the white pine tract, is a great deal more accessible, and will serve well for the planned investigation This area includes the hills surrounding Coeur d'Alene Lake, and extends up the St. Joe River as far as St. Maries, Idaho. (See Map of Coeur d'Alene Lake) There are a few patches of virgin yellow pine timber within this tract, but the greatest part of the area has been logged many years ago, and is now timbered by the small trees left at the time of cutting. Large areas have been

burned and support no merchantable timber at this time. The entire tract is covered each year by an extensive reconnaissance. Smaller units through-out the area are used for intensive study and observation.

METHOD OF PRESENTING DATA.

The four point as given under the caption " PURPOSE OF INVESTIGATION ", will be discussed separately and the two phases of the problem presented under each. (Reference is made to the second paragraph, page three, for description of the two problem phases)

I.

TO DETERMINE THE IMPORTANCE FROM AN ECONOMIC VIEWPOINT, OF THE DEPREDATIONS BY DENDROCTONUS BEETLES IN THE FORESTS OF NORTHERN IDAHO.

Depredations in White Pine by Dendroctonus monticolae.

(Table # 1.)
Table of acerage and timber stands
Coeur d'Alene National Forest.

	Total Acerage	White Pine Acerage	% of Stand	Volume of Timber all species	Volume of White pine	% of volume.
Coeur d'Alene National For.	651,000 A	268,000 A	.41	4,100,000,000	1,500,000,000	.36

During August 1920, an insect reconnaissance was made over the entire Coeur d'Alene, National Forest. (See map of Forest) Due to insufficient time this survey was very extensive and the results obtained are estimates only, however they are believed to be very conservative.

(Table # 2.)
Table showing estimated damage to white pine stands of the Coeur d'Alene National Forest by Dendroctonus monticolae.

Total Volume of White Pine	Year of Attack	Volume of White Pine Killed	Percent of the Total Volume.
1,500,000,000 b.f.	1919	4,500,000	.003

(Table # 3.)
Table showing percentage loss of Coeur d'Alene National Forest as applied to District 1.(Idaho & Montana)

Year of Attack	Loss to Coeur d'Alene National Forest	White Pine Volume of District 1.	Volume of White Pine Killed.
1919	.003	4,658,000,000	13,974,000

The figures for the acerage and volume of the areas mentioned were obtained through the courtesy of the United States Forest Service.

Summary of data
obtained from Independence Creek check area.

(Table # 4.)
Table showing timber stands
and acerage of Independence Creek check area.

Unit	Total timbered acerage	White Pine acerage	Volume of Timber all species Board feet.	Volume of White Pine Board Feet	Percent of total volume indicating White Pine.
Independence Creek	5000	1500	8,725, 790	3,967,960	.45
Snow Creek	2500	800	5,000,000.	2,000,000.	.40
North Creek	3500	1000	5,000,000.	1,750,000	.35

The figures for acerage and volume of Independence Creek were secured from the Forest Service, while those for Snow, and North Creek are estimates only.

(Table #5.)
Table showing the volume of white pine
killed by Dendroctonus monticolae during the 1919 attack.

Unit	Number of trees killed.	Average Volume per tree	Total Volume Killed Board Feet.	Total Volume of white pine. Board feet	Percent of total white pine volume killed in 1919.
Independence Creek	58	692 b.f.	40,190	3,967,960	.01
Snow Creek	14 * ~~29~~	692 b.f.	9,688 ~~19,868~~	2,000,000	.004 ~~.008~~
North Creek	29 * ~~14~~	692 b.f.	19,868 ~~9,688~~	1,750,000	.01 ~~.005~~

*The number of trees killed on Snow and North Creeks was obtained by a correction factor of 30 %, over the number of trees counted. This factor was obtained by the extensive and intensive reconnaissance on Independence Creek.
Average volume per tree for Snow and North Creeks, was taken from the intensive survey of Independence Creek.

(See map of Independence Creek)

(Table # 6.)

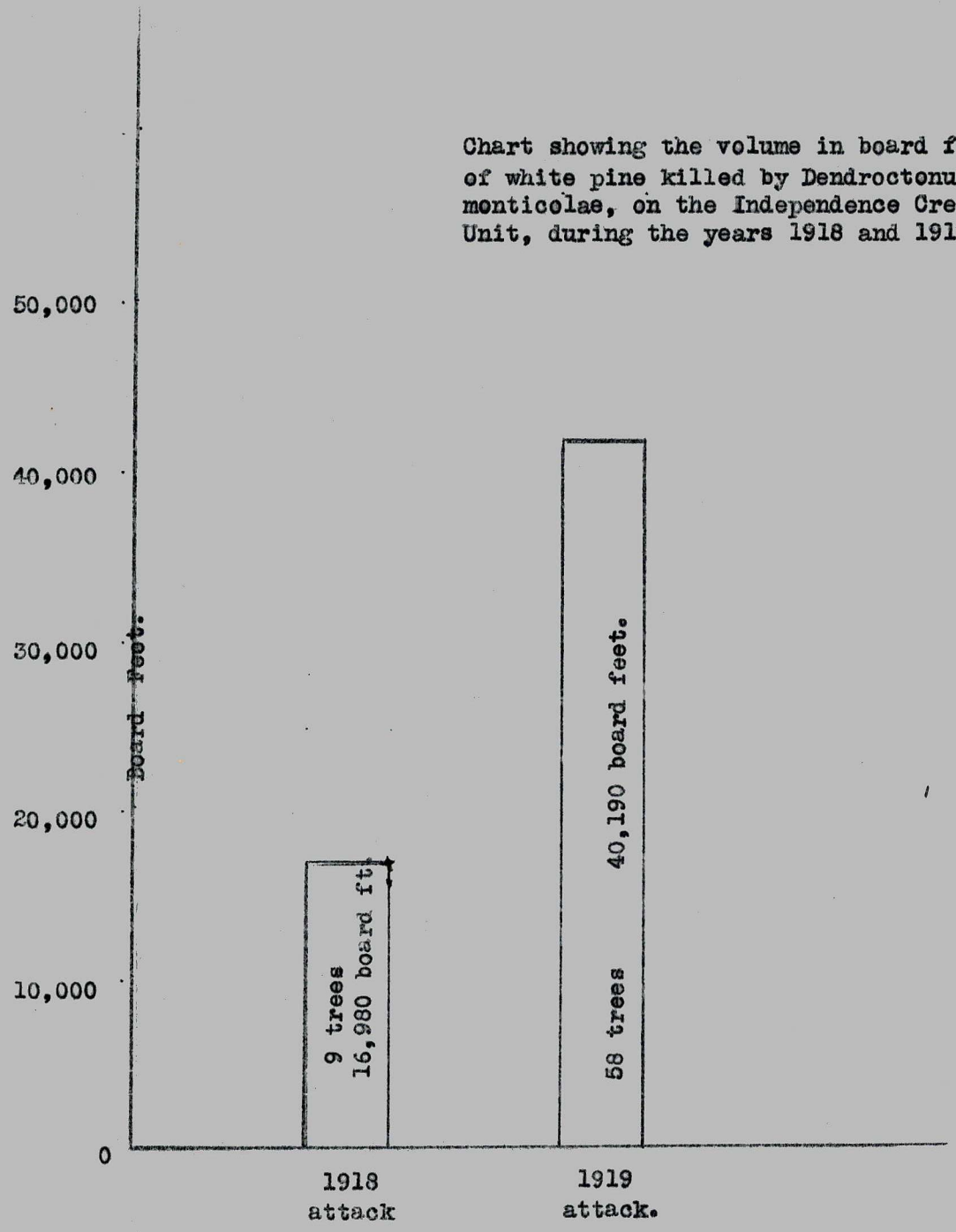
Table showing yearly volume of white pine killed
by Dendroctonus monticolae on the Independence Creek Unit.

Year of attack	Number of trees	Average D.B.H.	Average Volume Board feet	Total Volume Board feet	Percent of yearly increase or decrease of volume	Percent of total stand.
1918	9	26"	1,887	16,980	------	.004
1919	58	23.3"	692	40,190	1.36	.01
1920	It is believed that the data for this years attack will show a substantial increase over that of the preceding year.					

Though there are several very interesting points brought out by the preceding tables which might warrent discussion in this paper, it is believed that as sufficient time has not been spent upon this problem to secure conclusive data they are best omitted at this time. With the addition of another years data points will be brought out which if thought worthy of further consideration, can be covered by a more intensive study the following seasons.

(Chart # 1.)

Chart showing the volume in board feet, of white pine killed by Dendroctonus monticolae, on the Independence Creek Unit, during the years 1918 and 1919.



Depredations in Yellow Pine by Dendroctonus brevicomis.

(Table # 7.)
Table showing acerage and timber stands
of Coeur d'Alene Lake Area.

Total acerage	Yellow Pine Type		Lands supporting Yellow P.			Total Vol -ume of timber all species. B. F.	Yellow Pine Volume	
	Acerage	Percent of tot-al area	Acerage	Percent of tot-al stand	Percent of yel-low pine type.		Volume B.F.	Percent of total volume
70,000	44,000	.62	12,000	.17	.27	40,000 M	12,000 M	.30

The figures in the above table are estimates by the writer.

For description of the Coeur d'Alene Lake area, reference is made to page 5, of this report.

In the original plan of this area there seven small units which were to be used for intensive studies and checks on the entire tract. During the past season it was found impossible to cover all of them, therefore the data from only five check units will be presented in this report.

(Table # 8.)

Table showing difference in the results secured by the extensive and intensive reconnaissance and the correction factor obtained.

Name and number of unit	Numbe of trees spotted. Extensive reconnaissance	Number of trees counted. Intensive reconnaissance	Correction for each unit Percent	Average correction for year. Percent.
"B" Trees. 1918 Attack				
# 1 Blackwell Unit	36	43	.19	
# 2 Tubbs Hill Unit	17	19	.11	
#3 Kid Island Unit	9	10	.10	.12
# 4 Niggerhead Unit	29	36	.24	
# 5 Driftwood Unit	12	12	.00	
"C" Trees 1919 Attack				
# 1 Blackwell Unit	12	14	.16	
# 2 Tubbs Hill Unit	15	16	.06	
# 3 Kid Island Unit	00	00	.00	.11
# 4 Niggerhead Unit	4	5	.25	
# 5 Driftwood Unit	4	4	.00	

No trees attacked on the Kid Island Unit during 1919.

(Table # 9)

Table showing yearly volume of yellow pine killed by Dendroctonus brevicomis on the Coeur d'Alene Lake Unit

Year of Attack	Number of trees killed			Average volume per tree	Total volume killed B.F.	Total Volume of Yellow Pine B.F.	Percent of total stand Killed.
	Number of trees. counted	Correction factor	Total number				
1918	369	12%	413	235 B.F.	97,055	12,000,000	.008
1919	142	11%	158	255 B.F.	40,290	12,000,000	.003

(Table # 10.)

Table showing yearly volume of yellow pine killed
by insects on units covered by intensive reconnaissance.
(Volumes in Board Feet)

Year of attack	Yellow Pine timber killed: Dend. brevicomis # of tr.s	Ave. vol. trees	Total. vol-ume.	Ips # of tree	Ave. vol. trees	Total. vol-ume	Buprestidae # of tr.s	Ave. vol. trees	Total. vol-ume	Grand total volume	Total yellow pine volume	Percent of total stand killed.
Blackwell Check Unit # 1.												
1917	16	335	5,355	13	22	290	1	20	20	5,665	500,000	.011
1918	21	121	2,540	3	27	80	2	35	70	2,690	500,000	.005
1919	4	306	1,225	1	10	10	2	600	1200	2,435	500,000	.0048
Tubbs Hill Check Unit # 2.												
1917	2	235	670							670	250,000	.0026
1918	7	316	2,210	1	10	10	1	480	480	2,700	250,000	.01
1919	7	256	1,790				3	42	125	1,910	250,000	.0076
Kid Island Check Unit # 3.												
1917												
1918	10	670	6,700							6,700	250,000	.026
1919												
Nigger Head Check Unit # 4.												
1917	18	116	2,090	6	42	250	9	159	1,430	3,770	275,000	.013
1918	19	257	4,885	6	192	1,150	4	32	130	6,165	275,000	.022
1919	3	56	170	1	250	250				420	275,000	.0015
Driftwood Check Unit # 5												
1917	27	116	4,570	1	10	10	1	100	100	4,680	265,000	.017
1918	6	89	530			2	2	170	340	870	265,000	.0032
1919	2	755	1,510			1	1	160	160	1,670	265,000	.0063

Average percent of stand lost on all intensive check units

.0087 - 1917 -
.0132 - 1918 -
.004 - 1919 -

Percet of stand lost of entire Coeur d'Alene Lake Area.

No data.
1000 .008
.003

(Table # 11.)

Table showing yearly volume of Douglas Fir Killed by Dendroctonus pseudotsugae on unite covered by intensive reconnaissance.(Volumes in Board Feet)

Name and number of unit	Year of attack	DOUGLAS FIR KILLED # of trees	Average Volume per tree	Total volume	Total volume of Douglas Fir	Percent of total stand killed.
# 1 Blackwell Unit	1917	1	890	890	100,000	.009
	1918	5	272	1360	100,000	.013
	1919	-	-	-	100,000	-
# 2 Tubbs Hill Unit	1917	-	-	-	40,000	-
	1918	2	740	1480	40,000	.037
	1919	-	-	-	40,000	-
# 3	No Douglas Fir depredations of Kid Island Check Unit.					
# 4	No Douglas Fir depredations on Niggerhead Check Unit.					
# 5 Driftwood Unit	1917	1	1810	1810	65,000	.027
	1918	2	667	1335	65,000	.02
	1919	-	-	-	65,000	-

(Table # 12.)

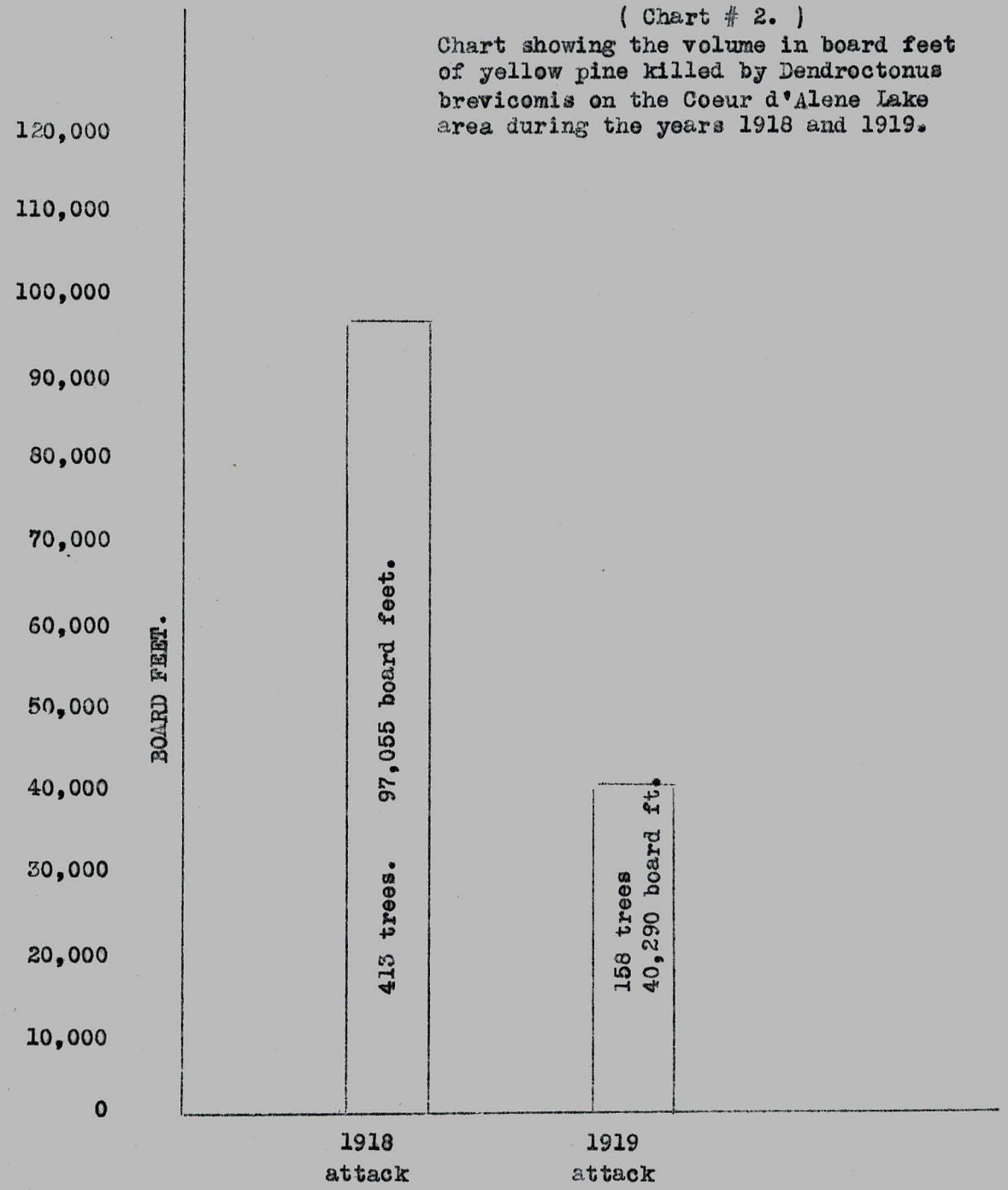
Table showing yearly volume of "Top Killed"* yellow pine on units covered by intensive reconnaissance. (Volumes in BoardvFeet)

Name and number of unit	Year of attack	TOP KILLED YELLOW PINE. # of trees	Total Volume of trees	Average percent of tree killed	Percent of Vol. killed	Total stand Y.Pine	Percent of total stand killed.
# 1 Blackwell Unit	1917	2	670	.36	241	500,000	.0004
	1918	12	3235	.41	1326	500,000	.0026
	1919	5	1260	.51	642	500,000	.0012
# 2 Tubbs Hill Unit	1917	3	305	.51	155	250,000	.0006
	1918	8	960	.40	384	250,000	.0015
	1919	6	810	.43	348	250,000	.0013
# 3	No Top Killed yellow pine in Kid Island Unit.						
# 4 Niggerhead Unit	1917	5	1355	.46	623	275,000	.0022
	1918	19	4530	.38	1721	275,000	.0062
	1919	1	180	.79	142	275,000	.0005
# 5 Driftwood Unit	1917	1	610	.40	244	265,000	.0009
	1918	2	630	.35	220	265,000	.0008
	1919	1	80	.70	56	265,000	.0002

* Tree killed in the upper part of the bole by insects.

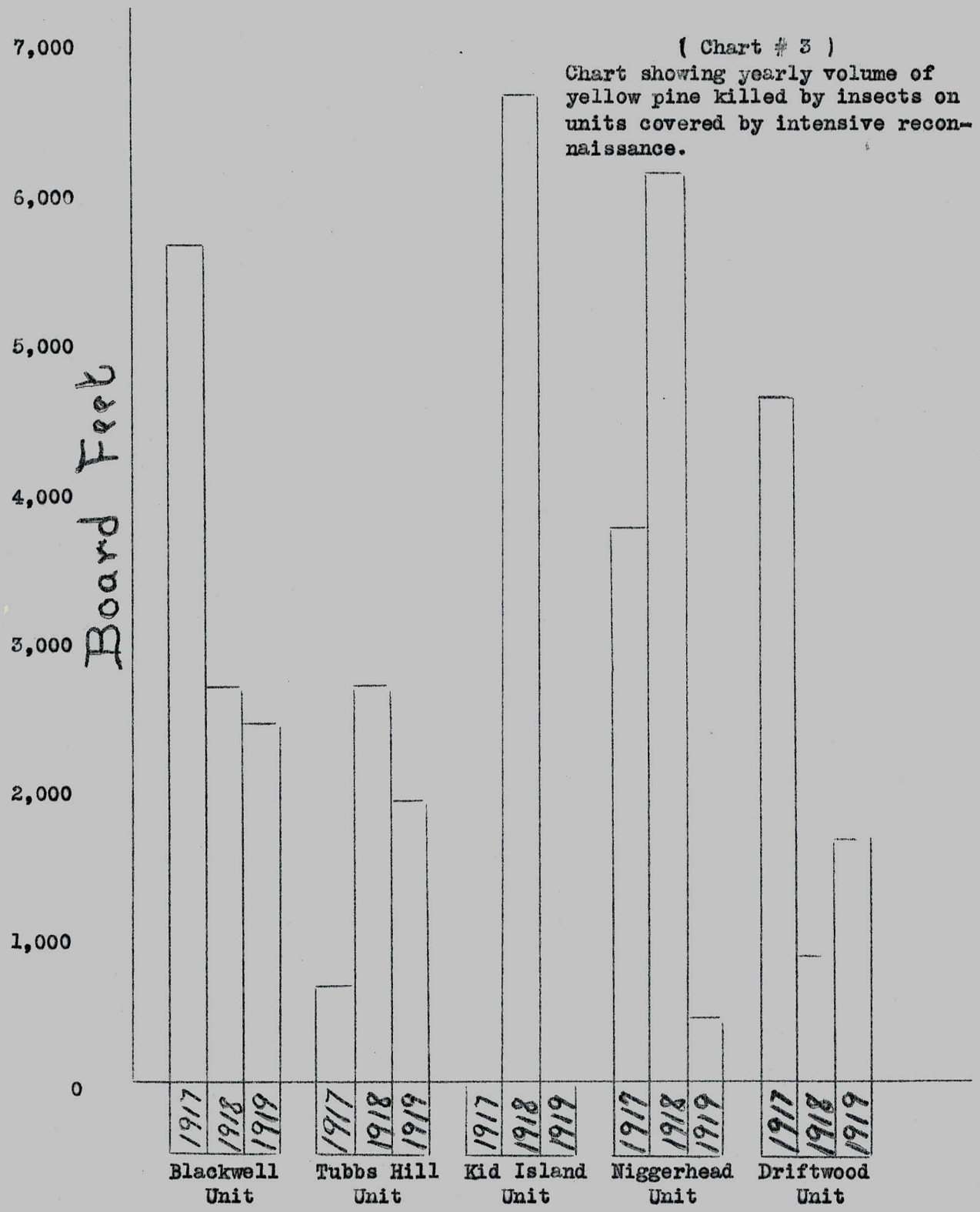
(Chart # 2.)

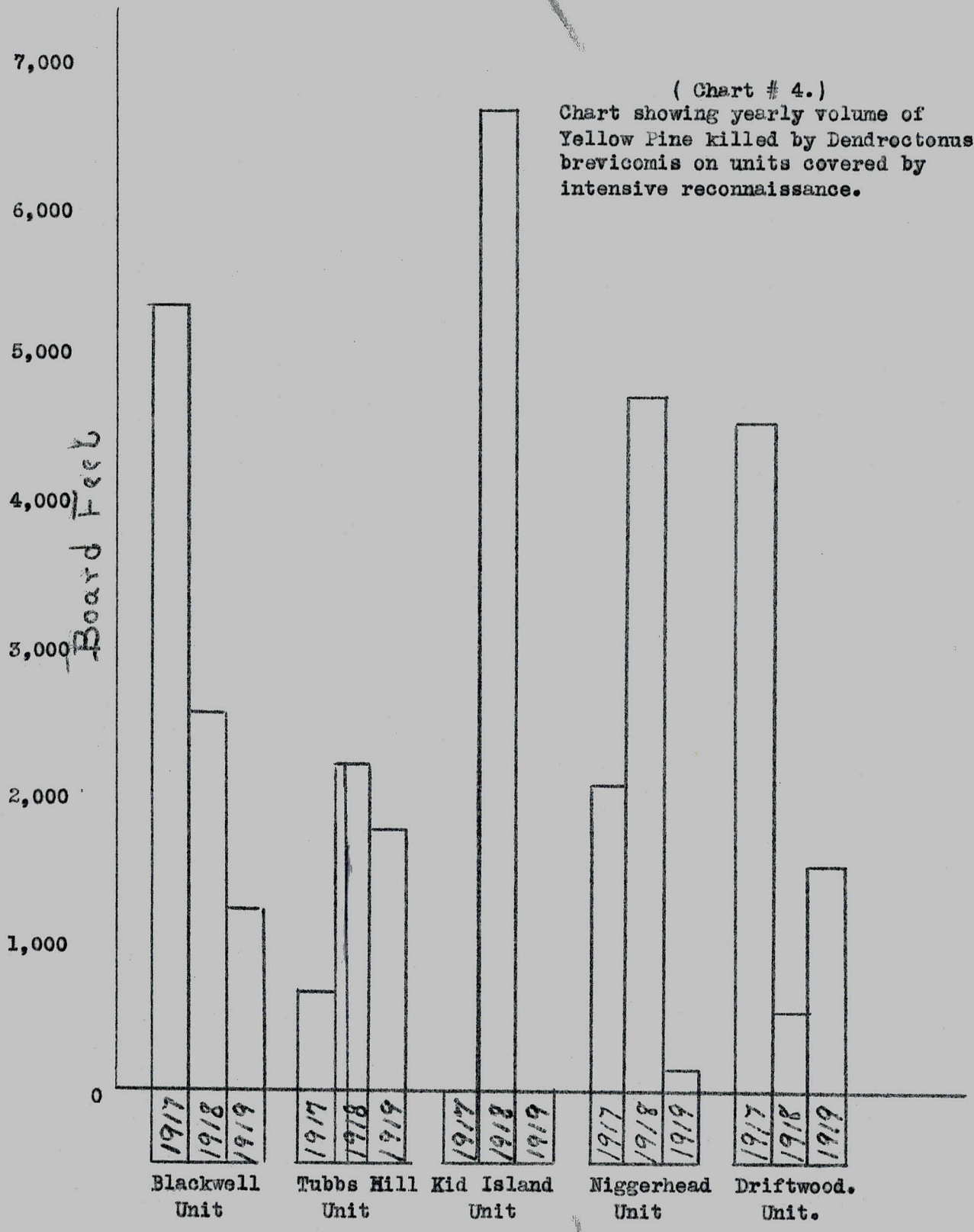
Chart showing the volume in board feet of yellow pine killed by Dendroctonus brevicomis on the Coeur d'Alene Lake area during the years 1918 and 1919.



(Chart # 3)

Chart showing yearly volume of yellow pine killed by insects on units covered by intensive reconnaissance.





(Chart # 4.)
Chart showing yearly volume of Yellow Pine killed by Dendroctonus brevicomis on units covered by intensive reconnaissance.

As in the case of the depredations in white pine no conclusions will be drawn from the tables and charts presented as sufficient data has not been secured to support any deductions made.

II

THE CAUSE, CHARACTER, AND PERIOD OF TIME, RELATIVE TO THE INTERMITTENT INCREASE AND DECREASE IN THE ANNUAL INFESTATION.

Depredations in White Pine by Dendroctonus monticolae.

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To clearly establish the fact that there is a natural rise and fall, or cycle of Dendroctonus infestations, the reason for it must be determined. This may be one or a combination of several natural factors. The most probable of all these is no doubt the natural enemies of Dendroctonus beetles, assisted by favorable climatical conditions. Predacious and parasitic insects, and insectivorous birds take a very important part in the control of insect epidemics. To secure conclusive proof of the value of predacious and parasitic insects in affording natural control of insect depredations, an infestation must be followed through the cycle, and data obtained from all stages of the epidemic. During the examination of the 1918, and 1919, Dendroctonus monticolae infestations in white pine very few predacious or parasitic insects were found. A few Enoclerus sphegus, and Trogosita virescens larvae could be found in some of the infested trees and logs. Data will be taken on this phase through-out the problem.

Depredations in Yellow Pine by Dendroctonus brevicomis.

The infestation in yellow pine by Dendroctonus brevicomis has been decreasing in severity very rapidly since the 1917 attack. It is estimated that the highest point of the cycle was reached by the 1917 attack. During the seasons of 1919, and 1920, very few predacious or parasitic insects were to be found. There were a few Enoclerus nigriventris larvae collected from Dendroctonus brevicomis galleries, and a few adult Temnochila virescens from the destroyed cambium and the larval mines in the outer bark. Dolichopodidae larvae (Possible Medeterus sp.) were very plentiful and in many instances collected while feeding upon the destroyed Dendroctonus larvae or pupa. A few Chalcididae larvae were present in many trees but were not plentiful enough to have had any influence on the mortality of the broods.

A very small percent of the yellow pine trees killed by Dendroctonus brevicomis show any evidence of woodpecker work. However it is believed that woodpeckers are a very important factor in assisting to place forest insect epidemics under natural control. Generally large trees containing very heavy attacks of Dendroctonus beetles are selected by these birds to furnish their food supply, and it is not uncommon to find all of the broods within the tree destroyed.

However in spite of natural agencies of control which attack the Dendroctonus broods while in the tree, there has been each year an apparent normal emergence followed by a below normal attack the same year.

This fact has lead to the belief that the period of greatest mortality of Dendroctonus brevicomis, is in the mature adult stage from the time of emergence to the new attack. This point is worthy of future study as it has a direct bearing upon the solution of this problem.

III

STUDIES OF SEASONAL HISTORY, CONDITIONS INFLUENCING RATE OF MORTALITY, FACTORS WHICH INDUCE BEETLES TO ATTACK CERTAIN INDIVIDUALS OF THEIR HOST SPECIES; F *LIGHT HABITS, etc.

(SEASONAL HISTORY, STUDIES OF,)

Dendroctonus monticolae.

The data which has been obtained by the writer since 1915 has lead to the belief that there is but one generation per season of Dendroctonus monticolae in white pine infestations of Northern Idaho. The winter season is passed by this insect in the larval stage, with the exception of a very small percent of the broods which mature to new adults before winter and emerge the following spring. The origin of the broods of overwintered adults has not been definately determined, however being abnormal it is apparently the result of a retarded emergence from a normal brood.

KEY TO SEASONAL HISTORY CHARTS.

1.	- Attack	4.	- Pupa	a.	Event number
2.	- Egg	5.	- Adults	b.	Event number in days
3.	- Larva	6.	- Emergence.	c.	Last event in period of days.

(Chart #5.)

Seasonal History Chart.

Dendroctonus monticolae. Pinus monticolae (White Pine)

(Overwintered adults)

		1919										1920	
		May		June		July		Aug.		Oct		May	June
		24	12	18	27	3	24	1	18	15	19	15	3
a.		144	163	169	178	183	205	213	230	288	292	136	155
	b.												c.
1		1	1										
2	25	. . . . .	2	2	2	. . . . .							20
3	9	. . . . .	3	3	3	. . . . .							22
4	35	. . . . .	4	4	4	. . . . .							83
5	7	. . . . .	5	5	5	5	5						4
6	271	. . . . .	6	6	--								

(Chart # 6.)

Seasonal History Chart.

Dendroctonus monticolae. Pinus monticola (White Pine)

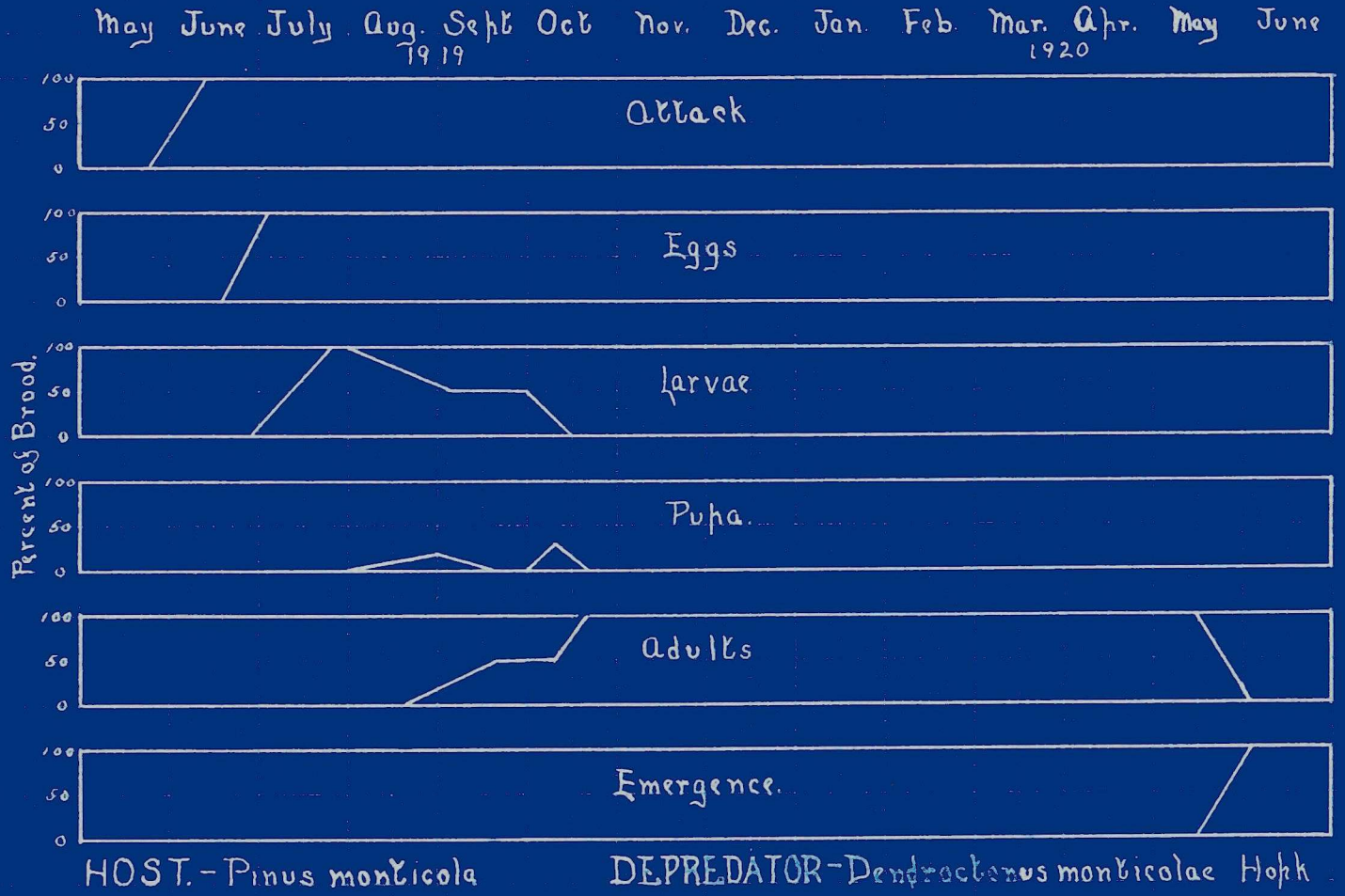
(Overwintered larvae. First Brood.)

		1919						1920					
		July		Aug.		Sept		June		July		Aug	
		15	3	9	18	18	6	24	30	15	24	9	
a.		196	214	221	230	261	158	176	181	197	206	221	
	b.												c.
1		1	1	1									
2	18	. . . .	2	2	2	2	. . . . .						40
3	16	. . . . .	3	3	3	3	3	. . . . .					285
4	293	. . . . .	4	4	4	4	4	. . .					25
5	18	. . . . .	5	5	5	5	5	15					
6	21	. . . . .	6	6	6								

(Overwintered larvae. Last Brood.)

		1919				1920					
		Aug.		Sept.		July		Aug.			
		6	21	3	24	12	21	3	6	12	21	
a.	b.	218	233	246	267	194	203	216	219	225	234	c.
1		1	1									
2	15	. . . . .	2	2	2	. . . . .						34
3	13	. . . . .	3	3	3	3	3	. . . . .				314
4	313	. . . . .	4	4	4	4	4	. . . .				9
5	9	. . . . .	5	5	5	5	5	5				9
6	16	. . . . .	6	6	6							-

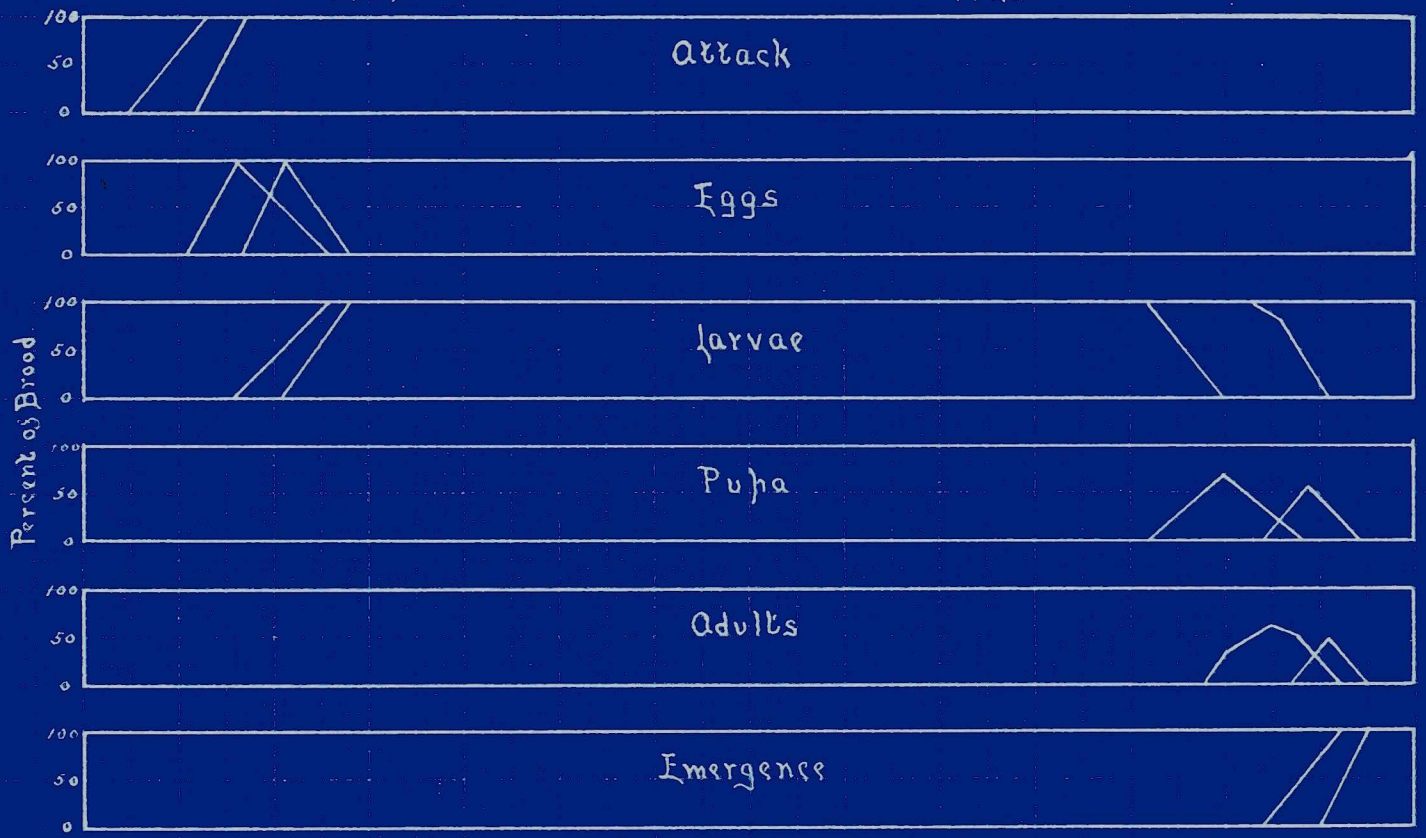
SEASONAL HISTORY CHART



HOST.- Pinus monticola DEPREDATOR- Dendroctonus monticolae Hopk

Coeur d'Alene National Forest. J.E.

SEASONAL HISTORY CHART



HOST - Pinus monticola DEPREDATOR - Dendroctonus monticolae Hopk.

Showing range of event periods

Coeur d'Alene National Forest J.C.E.

As it was impossible to devote sufficient time to the seasonal history studies to carry on continuous observations these charts are not authentic, but are presented as the results of the limited data obtained.

(Dendroctonus brevicomis)

From the observations made at this station during the past two years, there has been no indication of the presence of more than one generation per season. A few instances of overwintering adults have been found, but it has been impossible to follow these broods. There is sometimes a delayed emergence of an entire, or part of a brood, the future of which is unknown. It is believed that the occasional " pitched out attack", which is found in this area, is the result of this late emergence.

(Chart #7 .)
Seasonal History Chart.

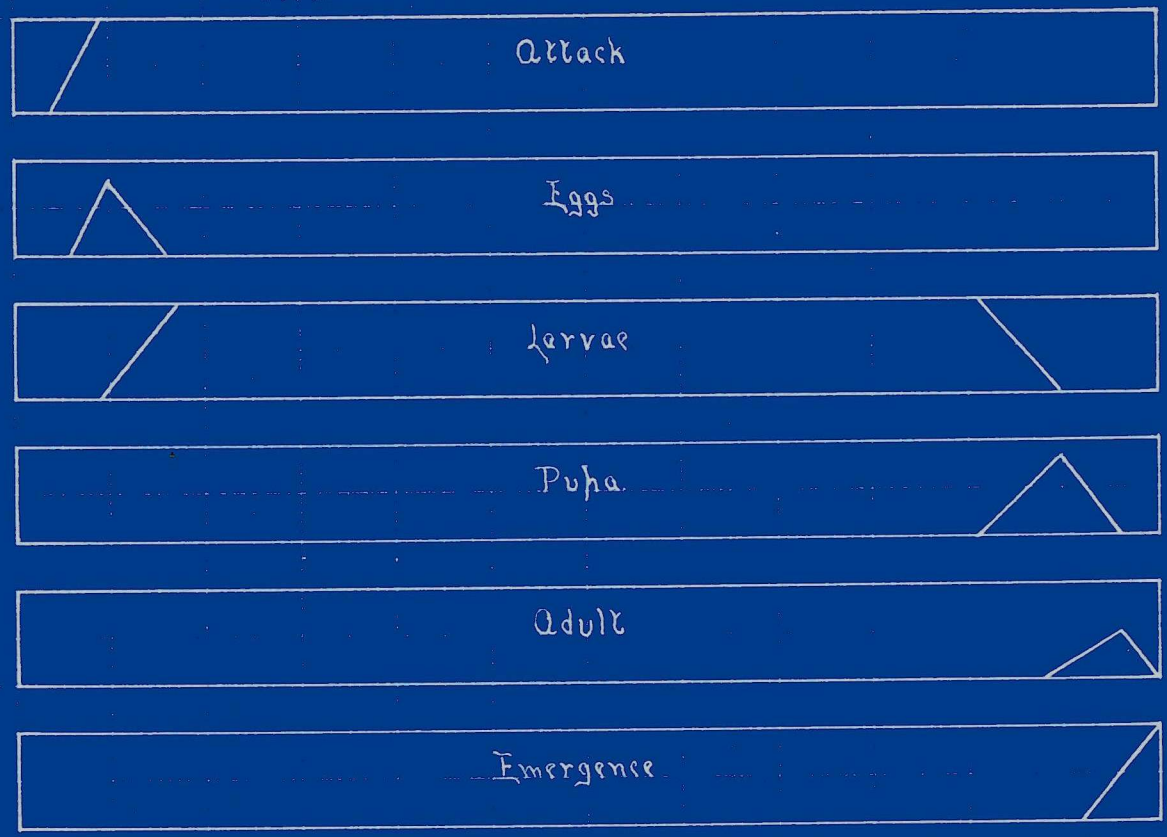
Dendroctonus brevicomis. Pinus ponderosa (Yellow Pine)

		JULY 1919					: MAY 1920		: JUNE 1920				
		12	18	25	27	30	4	24	1	6	18	30	
a.	b.	191	197	204	206	209	125	145	153	158	170	182	c
1		1	1	1	1								
2	6	. . . . .	2	2	2	2	. . . . .						3
3	7	. . . . .		3	3	3	3	3	3	. . . . .			307
4	286	. . . . .					4	4	4	4	4	. .	17
5	20	. . . . .					5	5	5	5	5	. .5	12
6	13	. . . . .							6	6	6	6	

Emergence complete June 30, 1920.

SEASONAL HISTORY CHART

July Aug. Sept. Oct. Nov. Dec. Jan Feb. Mar. Apr. May June
1919. 1920.



HOST,-Pinus ponderosa. DEPREDATOR,-Dendroctonus brevicomis. Lec.

Coeur d'Alene, Idaho. J.C.E.

(CONDITIONS INFLUENCING RATE OF MORTALITY.)

Dendroctonus monticolae.

Very little data has been secured relative to this phase of the problem. As the depredations in white pine by Dendroctonus monticolae are increasing at this time, and the percent of mortality within the insect broods is very low, it is believed that no worthwhile data can be secured until the highest point of the cycle has been reached and the damage starts to decrease.

Dendroctonus brevicomis.

During the past two seasons, though the depredations in yellow pine by Dendroctonus brevicomis have been decreasing, very little information on this question has been secured. Predacious and parasitic insects were present to a more or less extent (See page 19.), and no doubt a certain percent of the broods were destroyed by these agencies. However regardless of this benificial assistance there was generally a normal emergence of adults followed by a below normal attack. It has already been brought out in this report (Page 20.) that the writer believes that the period of the greatest mortality of these insects, is from the time of emergence to the subsequent attack. Information relative to the reason for this fact has not been secured.

FACTORS WHICH INDUCE BEETLES TO ATTACK CERTAIN INDIVIDUALS OF THEIR HOST SPECIES.

The possibility that during the endemic period of an infestation Dendroctonus beetles attack decadent and injured trees, windfalls, etc., and while in the epidemic stage select the more healthy and resistant trees, is worthy of future consideration. It is believed that the reason for the selection of individuals of the host species, is a question of resistance of the tree. No other solution seems to explain why one of two or more trees, which in all physical appearances are the same, is selected for attack.

Dendroctonus monticolae attacks.

(Table # 13.)
Table showing decadent white pine attacked by Dendroctonus monticolae on Independence Creek Check Unit.

Year of attack.	Total # of trees killed	Number of decadent trees.	Percent of decadent trees.	Total volume killed. Board Feet.	Volume of decadent trees Board Feet.	Percent of decadent volume.
1918	9	4	.44	16,980	11,900	.70
1919	58	15	.25	40,190	16,165	.40

(Table # 14.)
Table showing degree of resistance of of white pine killed on Independence Creek Check Unit.

Year of attack	Number of decadent trees killed	Fire scorched trees with little power of resistance.	Overmature trees with reasonable resistance.	Volume of fire scorched trees	Volume of overmature trees.
1918	4	3	1	8,400 B.F.	3,500 B.F.
1919	15	6	9	2,585 B.F.	13,580 B.F.

Dendroctonus brevicomis attacks.

(Table # 15.)
Table showing decadent yellow pine killed by Dendroctonus brevicomis on units covered by intensive reconnaissance .

Area	Year of attack	Number of trees killed. Healthy	Decadent	Percent	Total volume of timber killed. B. F.	Volume of decadent timber B.F.	Percent of total stand.
#1	1917	16	4	.25	5,355	3,255	.607
Blackwell	1918	21	1	.04	2,540	620	.240
Unit	1919	4	2	.50	1,225	1,055	.820
# 2	1917	2	0	.00	670	000	.000
Tubbs Hill	1918	7	2	.28	2,210	290	.130
Unit	1919	7	2	.28	1,790	570	.310
# 3	1917	-	-	-	-	-	-
Kid Island	1918	10	-	-	6,700	-	-
Unit	1919	-	-	-	-	-	-
# 4	1917	18	-	-	2,990	-	-
Niggerhead	1918	19	-	-	4,885	-	-
Unit	1919	3	1	.33	170	70	.410
# 5	1917	27	-	-	4,510	-	-
Driftwood	1918	6	-	-	530	-	-
Unit	1919	2	1	.~~50~~ .50	1,510	50	.03

A more detailed study will be made of this phase of the problem in an effort to obtain more tangible evidence.

(FLIGHT HABITS.)

Dendroctonus monticolae.

From and examination of the map of Independence Creek enclosed with this report, on which all insect killed trees are marked, it appears that the Dendroctonus beetles spread in all directions from the 1918, to the 1919 attack. In order to connect the 1919, to the 1918 infestation

distances of three-quarters of a mile or more will have to be covered. Realizing that it is entirely possible, and that no doubt Dendroctonus monticolae does often fly such distances as mentioned above in the search for suitable hosts, the writer is of the belief that unless attracted to freshly cut timber, the normal flight of this insect does not cover a very great distance. It is further believed that the origin of many new centers of infestations is not by the migration of the beetles from other points, but is the result of a concealed infestation carried through the endemic period by windfalls, broken tops, etc. The difficulty of securing accurate data upon the flight of Dendroctonus beetles is very evident at this time.

Dendroctonus brevicomis.

Through-out the yellow pine forests of Northern Idaho, there is apparently a persistent, or normal infestation. During the endemic period this infestation is confined to scattered trees, which during the epidemic stage give rise to centers of infestation of more or less severity. As with Dendroctonus monticolae, it is belived that broods of these insects are carried over an endemic period as concealed infestations. For Dendroctonus brevicomis to fly long distances, when suitable host plants are available near at hand, is belived to be an abnormal habit, but entirely possible.

(FOREST FIRES AND SUBSEQUENT INSECT EPIDEMICS.)

Dendroctonus monticolae in Relation to Forest Fires

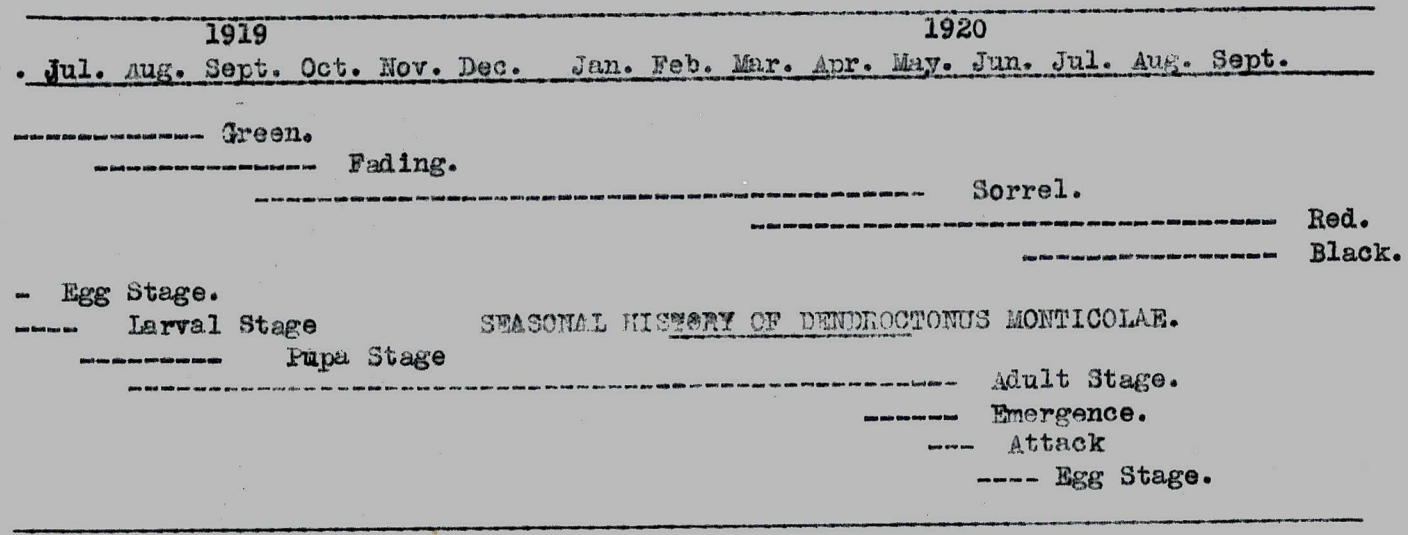
During the season of 1919, fires destroyed a large volume of white pine within this District. Some of these areas were visited during the past season, but no evidence of increased insect damage in the fire scorched timber, or in areas adjacent to the burns was secured. As but little time was available and it was thought that there would be but little appreciable evidence the year following the fire, it was planned to spend more time on this phase of the problem during the coming seasons.

In the year 1910 a severe fire burned to the ridge along the East side of North Creek(See map of Independence Creek), and totally destroyed all timber up to thismpoint. An examination of this area showed that very heavy insect losses in white pine had occured from 1912, to 1915. All fire scorched trees had been attacked and killed and the infestation spread to the healthy timber. This infestation was apparently drawn from the North, and possible Snow Creek Watersheds. This epidemic was very short lived as it died down with the general infestation over the entire forest in 1915. It is doubted if the actual loss was any greater as a result of the fire as a great part of the fire scorched timber would have died within a few year from the injury already received. It is hoped that some definate data can be secure which will be of assistance in the solution of this problem.

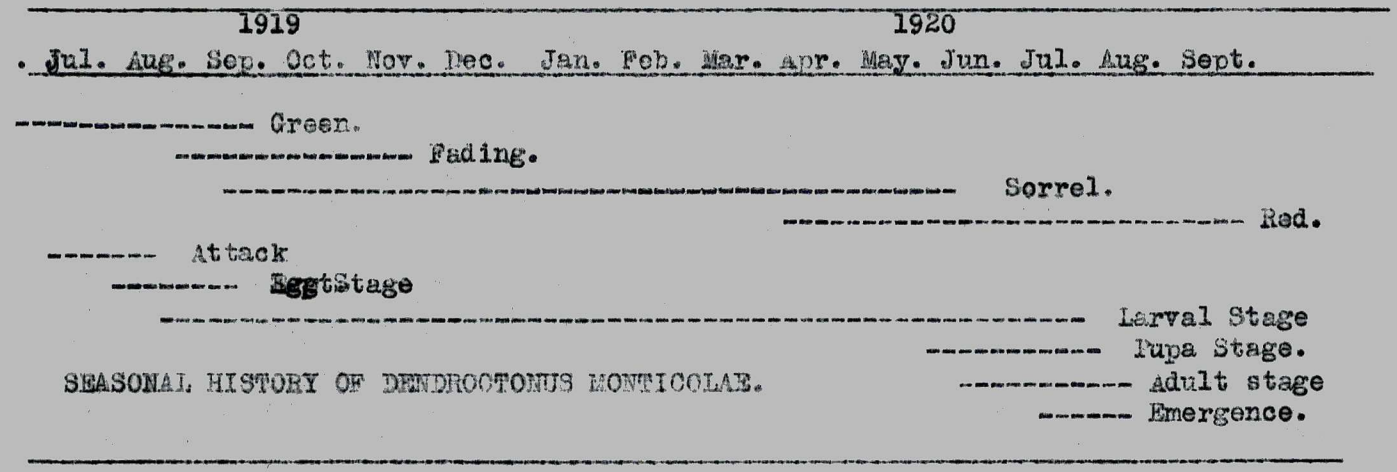
Dendroctonus brevicomis in Relation to Forest Fires.

During the season of 1919 about 30 A. of the yellow pine type of Tubbs Hill Check Unit, was covered by a surface fire. The underbrush was all killed and the trees severely scorched for a distance of 6 - 15 feet. This fire had no influence upon the infestation within the unit. At the time of the fire there were no infested trees within the area of the burn, and since that date none have been attacked. The infestation within this unit has followed the general lines of the other check units and of the entire Coeur d'Alene Lake Area. It is realized that the information given on this question is of little value, due to the smallness of the area involved. It is hoped that during the course of this problem a suitable situation will be available for future study.

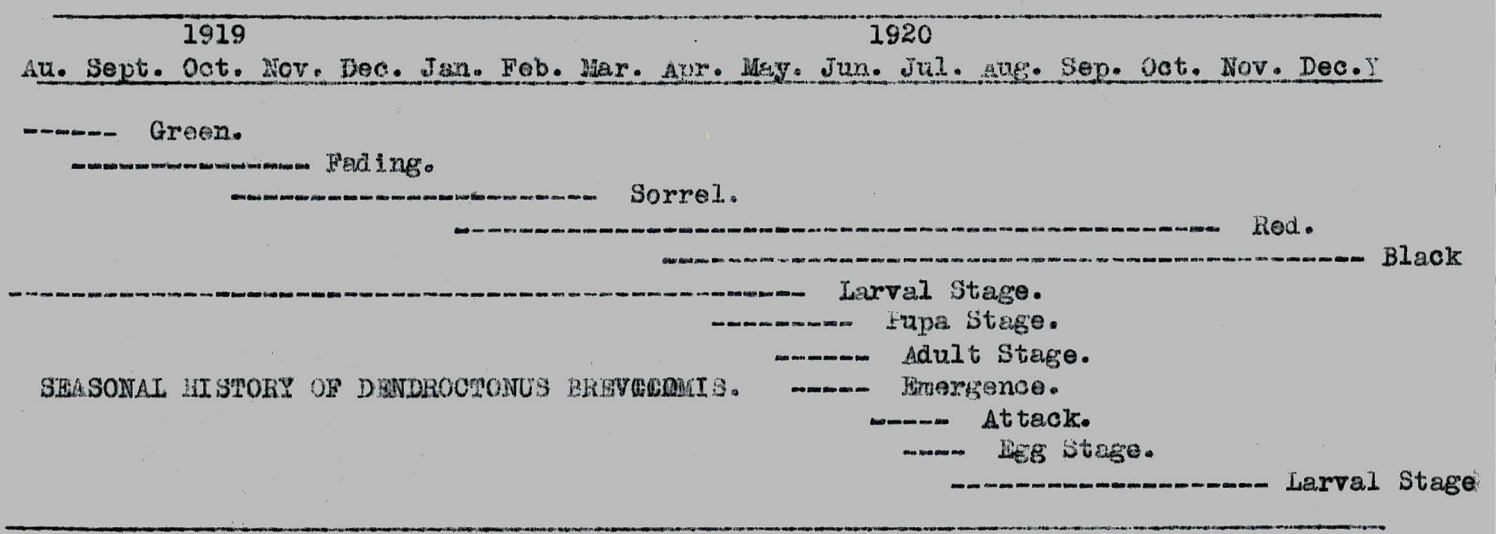
(FOLIAGE CHANGES.)
White Pine Attacked by Dendroctonus monticolae.
(Overwintered adult brood)



White pine attacked by Dendroctonus monticolae.
(Overwintered larvae brood)



Yellow Pine attacked by Dendroctonus brevciomis.



(Table # 16.)
Table showing the foliage variations
of ten trees located on the Blackwell Check Unit.

Yellow Pine Attacked by Dendroctonus brevicomis.
Records taken on November 23rd, 1920.

Tree no.	Year of Attack.	Stage of insect developement.	Condition of the tree.	Weakened by,	Foliage.
D - 1.	1920	New Adults	Mature - Normal.	-	Fading.
D - 2.	1920	Larvae 1/2 - 1	Mature - Normal	-	Fading.
D - 3.	1920	Larvae 1/2 - 1	Mature - Normal	Broken Top.	Fading.
D - 4.	1920	Larvae 1/2 - 1	Mature - Normal	-	Fading.
D - 5.	1920	Larvae 1/2 - 1	Mature - Thrifty	Fire Scars	Green
D - 6.	1920	Larvae 1/2 - 1	Mature - Decadent	Fire Scars (Light)	Sorrel.
D - 7.	1920	Destroyed *	Mature - Normal	-	Fading.
D- 8 .	1920	Larvae 1/2 - 1	Mature - Decadent	Top Killed 1918	Sorrel & Red
D - 9.	1920	Larvae 1/2 - 1	Mature - Decadent	Fungus	Fading.
D -10.	1920	Larvae 1/2 - 1	Mature - Thrifty	-	Green

* Brood destroyed by Sour Sap.

Though the data on hand is somewhat limited it is believed that due to the Resistance of the tree attacked, an absolute rule can not be applied to the yellow pine foliage changes, subsequent to the attack by Dendroctonus brevicomis.

IV.

TO INVESTIGATE SECONDARY INSECTS AND BARK BEETLES OF MINOR IMPORTANCE WITH THE CHARACTER AND EXTENT OF THE DAMAGE INVOLVED. ALSO THE RELATION OF THESE INSECTS TO THE PRIMARY SPECIES.

Dendroctonus monticolae and secondary insects.

In the Independence Creek Watershed approximately 5 percent of the total stand, or about 57,000 board feet of Engelman Spruce has been killed in the past ten years by Dendroctonus engelmanni. There is no evidence of any new work only in wind falls.

Several bark, and timber beetles have been collected associated with, or following the attack of Dendroctonus monticolae, but no relationship has as yet been developed.

The White Pine Butterfly(Neophasia menapia) can always be found in the white pine stands during the month of August. During the past season they were reported as being present in very large numbers on the holdings of the Rutledge Timber Company.

Dendroctonus brevicomis and secondary insects,

Reference is made to tables number 10 and 11 for the importance of secondary forest insects, in association with Dendroctonus brevicomis, infestations in yellow pine. The relationship of these insects to the primary species is very complex and it is doubted if any

definate or absolute rule can be determined.

Trees harboring an attack at the base by Buprestidae, will upon examination generally prove to have the upper part of the bole attacked by Dendroctonus brevicomis. However the initial attack is not known.

The relationship of Ips oregonis, to Dendroctonus brevicomis attacks, is still more complicated. Apparently every possible combination of joint and seperate attacks are possible. It is believed that there is no relation between the attacks of these insects, only as one may be attracted to a weakened uninfested part of a tree, caused by the attack of the other. Reproduction averaging from 4 to 8 inches in dia. is often severely injured by the attacks of Ips oregonis. In 1918 on the Blackwell Check Unit, 182 yellow pine trees averaging 6 inches in dia. were killed by this insect.

Small patches of thick yellow pine reproduction averaging 2 to 4 inches in dia. are often entirely destroyed in a season or two, by the attacks of Pityogenes carinulatus?(Hopk. U.S. Number 16334 A) (Determination not yet received) . These little epidemics can always be traced to a bit of slash contained within the area.

Ips integer, is often found attacking decadent or dying yellow pine. It is not considered important. Lepidopterous insects have been of no importance in this region for the past five years.

CONCLUSIONS

It has previously been stated that no conclusions or deductions , can be made from this report as the data secured are not sufficient to support the existence of any theory advanced at this time. However the salient points brought out by the compilation of the data will serve as an excellent groundwork for future investigations. It is the wish of the writer that this report be accepted as a discussion of the progress made on the problem assigned to the Coeur d'Alene Forest Insect Station, in June 1919.

Respectfully submitted,

James C. Evenden,
Specialist in Forest Entomology.

Forest Insect Station,
Coeur d'Alene, Idaho.
February 5th, 1921.

UPPER INDEPENDENCE CREEK
COEUR D'ALENE NATIONAL FOREST

J.S. Evenden.

LEGEND

- Boundary of 1910 fire.
- Boundary of commercial white pine stand.
- B — White pine trees killed in 1918 by D. monticolae.
- C — White pine trees killed in 1919 by D. monticolae.

T.53 N.

R.1 E.

Snow Creek

North Creek

Burned 1910

Sunrise Creek

Declaration Creek

Independence Creek

Snowbird Creek

9 10 11 12
17 16 15 14 13
19 20 21 22 23 24
30 29 28 27 26 25
31 32 33 34 35 36

COEUR D'ALENE NATIONAL FOREST

UPPER INDEPENDENCE CREEK

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
HENRY S. GRAVES, FORESTER

COEUR D'ALENE NATIONAL FOREST

IDAHO

BOISE MERIDIAN

1919

NATIONAL FOREST BOUNDARY

ADJACENT NATIONAL FOREST BOUNDARY

Scale 1 ½ 0 1 2 3 4 5 Miles

Legend

White Pine Type

Route covered by extensive reconnaissance

Compiled at Washington Office, August, 1918
from U. S. G. S., G. L. O., Forest Service, and other surveys
by R. R. Sabine
Traced by R. R. Sabine

Longitude West From Greenwich

PRINTED BY THE U. S. GEOLOGICAL SURVEY

Coeur d'Alene National Forest.

2.

COEUR D'ALENE LAKE

IDAHO

Intensive Check Areas

1. Blackwell
2. Tubbs Hill
3. Kid Island
4. Nigger Head
5. Driftwood

Pinus ponderosa killed by Dendroctonus brevicomis

Trees killed 1918

Trees killed 1919

Shoshone River
Fernan Lake
Coeur d'Alene City
Cougar Bay
Cresco Bay
Kid Island Bay
Stevens Pt.
Nigger Head
3 Mile Pt.
Cellar Pt.
Twin Beacho
Echo Bay
Wolf Lodge Bay
Marlow Bay
Beauty Bay
James P. Evenden
Mica Bay
Toad Rock
Driftwood Pt.
Ladel-card Bay
Rock Pt.
Turner Bay
Happy Cove
Gulp Landing
Loss's Bay
McDonald Pt.
Pilot Rock
Carlin Bay
Maritime Bay
Black Rock
North Round Bay
Powder Horn Bay
Rockford Bay
Rockford Pt.
East Pt.
Windy Bay
Thompson Lake
Blue Lake
Killarney Lake
Harrison
Cottonwood Bay
Black Lake
Blue Lake
Cave Lake
Medicine Lake
Conklin Park
Chatcolet Lake
St. Joe River
St Maries

T 50 N
T 49 N
T 48 N
T 47 N
T 46 N

R.5W. R.4W. R.3W. R.2W.

Coeur d'Alene Lake

2.